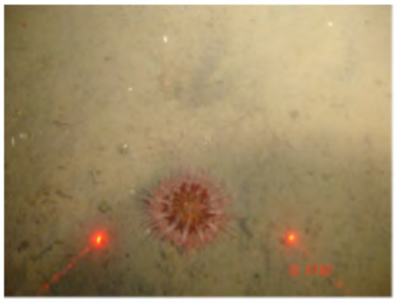

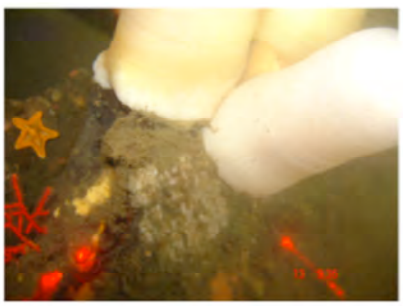

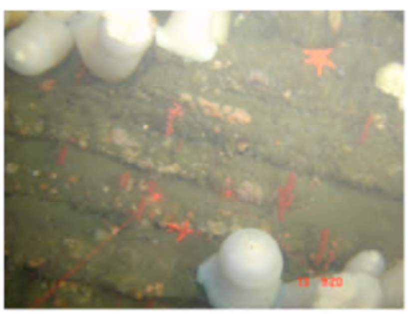

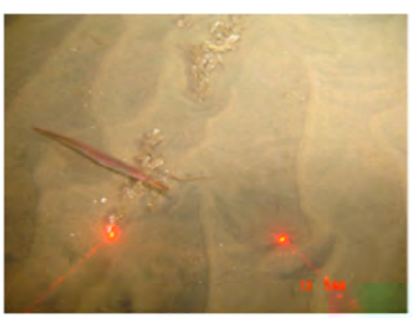

Survey Report:

Remotely Operated Vehicle (ROV) Biological Characterization Survey of the Asia America Gateway (AAG) S-5 Project Fiber Optic Cable Route Offshore Morro Bay, California

January 2008
Rev. May 2008

Prepared for:

AT&T Corporation
3D151F, 1 AT&T Way
Bedminster, NJ 07921

Prepared by:

APPLIED marine SCIENCES

4749 Bennett Drive, Suite L
Livermore, CA 94551

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Table of Contents

1.0 Executive Summary

On October 11-13, 2007, scientists from Applied Marine Sciences, Inc. (AMS) conducted a remotely operated vehicle (ROV) Biological Survey of 14 kilometers (7.6 nautical miles) of the initial proposed Asia America Gateway (AAG) S-5 cable route offshore California. The portion of the cable route surveyed is located between the offshore terminus of the Montana de Oro state park borepipe and approximately 150-meters water depth contour, offshore of Morro Bay, California (Figure 1). Subsequent to the execution of the biological survey in October 2007, data from a multi-bean side-scan sonar survey of the nearshore cable route resulted in an updated and more accurate seafloor habitat map. Information from this map, in combination with observations from the ROV Biological Survey, resulted in the initial proposed cable route being moved in several locations, in order to avoid hard-bottom habitat and achieve deeper burial. Both the initial surveyed cable route and the final proposed cable route are illustrated in Figures 3a-f.

During the ROV Biological Survey multiple marine habitats were observed and assessed along the proposed cable routes including both low- (<1m) and high-relief (>1m) hard-bottom areas, mixed sand and cobble, coarse sand formed into large sand waves and troughs, heavily bioturbated silt and fine sand, and fine sand and silt soft-substrate areas. Of the original14km of cable route surveyed during the ROV Biological Survey, the majority of the proposed route consisted of soft-sediment habitat (84.8%). The remainder of the route consisted of mixed sand and exposed cobble (9.1%), low-relief hard-bottom (4.1%), and high-relief hard-bottom (2.1%) habitat. The realigned final proposed cable route through the same coastal area surveyed during the ROV Biological Survey consists of approximately 85.6% soft-sediment habitat, 9.3% mixed cobble and sand, 3.4% low-relief hard-bottom habitat and 0.07% high-relief hard-bottom habitat, along its 14.6-km distance. The majority of high-relief hard-bottom habitat along the initial route was encountered in Survey Segment C and most of the low-relief hard-bottom habitat was encountered in Survey Segment D. One small high-relief feature occurred in Survey Segment E, within the 100-m cable right-of-way but ended 25m from the centerline. The realigned cable route encounters unavoidable hard-bottom habitat predominantly in Survey Segment D, and the high-relief hard-bottom feature located along the southern edge of the cable right-of-way in Survey Segment E is avoided completely. The mapping of the seafloor habitats observed during the biological reconnaissance survey closely matched and corroborated with the multi-beam geophysical seafloor mapping performed along the nearshore segment of the proposed cable route (Figures 3b-f).

The epibenthic invertebrate, algae, and fish species observed along the initial and final proposed cable routes are representative of hard-substrate and soft-substrate areas of central California and offshore Morro Bay. The epifauna observed in the soft substrate segments of the nearshore cable route right-of-way consisted of sea pens, including *Stylatula elongata*, *Acanthoptilum* sp., *Virgularia californica, Virgularia agassizii, Scytallum* sp., *Scytallopsis* sp., and *Ptilosarcus gurneyi,* brittle stars including *Amphiophodia urtica*, *Amphiopholis* sp., *Amphiodia* sp., *Ophionereis* sp., and *Ophiura* sp., the ceriantthid anemone *Pachycerianthus* sp., the anemones *Urticina piscivorus, Urticina sp*., and *Stomphia coccinea*, tube worms, cancer crabs including the slender crab (*Cancer gracilis*), hermit crabs, (*Paguristhes sp*.), shrimp, (*Pandalus sp*.), occasional marine snails (Gastropoda), the California sea slug (*Pleurobranchaea californica*), octopus (*Octopus rubescens*), and several species of sea stars including *Pisaster brevispinus*, *Petalaster (Luidia) foliolata, Rathbunaster californica, Asterina miniata, Solaster dawsonii, and Astropecten sp., the* ornate tube worm (*Diopatra ornata),* sand dollars (*Dendraster ecentricus*), the sea cucumber *Parastichopus sp*., occasional orange gorgonians (*Adelogorgia phyllostera*) attached to shallow buried rocks, and a free living polychaete fire worm (Amphinomidae). Squid (*Loligo* sp.) were also frequently observed in the water column.

Fish species observed in soft-bottom areas included assorted flatfish, such as sanddabs (*Citharichtys sp*.), California halibut (*Paralichthys californicus),* Dover sole (*Microstomus pacificus*) and English sole *(Pleuronectes vetulas),* tonguefish (*Symphurus atricauda),* pink surfperch (*Zalembius rosaceus*), tubesnout (*Aulorhynchus flavidus*), hagfish (*Etatretus stouti*), longspine combfish (*Zaniolepis latipinnus*), anchovies (*E. Mordax*), swell shark (*Cephaloscyllium ventriosum*), banded guitarfish (*Zapteryx exasperata), Pacific electric ray (Torpedo californica*), big eye skate (*Raja binoculata),* longnose skate *(Raja binoculata,* Pacific angel shark (*Squatina californica)*, olive rockfish (*Sebastes serrinoides), j*uvenile and adult rockfish (Sebastes sp.), eelpouts (*Lycodes* sp.), lingcod (*Ophiodon elongatus*), cuskeels (*Chilara* sp), poachers (Algonidae), and sculpins (Cotidae)*).*

In water depths less than 30.5m (100ft), ornate tubeworms (*D. ornata),* cancer crabs, and the sea pens *S. elongata and P. gurneyii* were the most frequently observed soft-bottom epifuanal invertebrates. In water depths greater than 30.5m (100ft) and less than 104m (340ft), sea pens, brittle stars, assorted sea stars including *P. foliolata, R. californica, Astropecten* sp., and *P. brevispinus,* the cerianthid anemone *Pachycerianthus* sp., the anemones *U. piscivorus, Urticina* sp., and *S. coccinea*, cancer crabs including the slender crab (*Cancer gracilis), and* octopus (*O. rubescens)* were the most abundant megafauna observed. Both the sea pen *P. gurneyi* and the seastar *P. brevispinus* were observed only at water depths of 48.8m (160ft) or less. In water depths greater than 104m (340ft) to the end of the ROV survey at 153m (500ft), the free-living fire worm (Amphinomidae) was the most abundant and dominant epifaunal organism, followed by sea pens and brittle stars.

Although sea pens were observed in all soft-bottom areas and at all water depths, the species composition shifted from *Stylatula elongata* and *Ptilosarcus gurneyi* in the shallowest water depths to *Virgularia californica, Virgularia agassizii, Scytallum* sp., and *Acanthoptilum* sp., at the deeper depths. A similar depth shift in brittle star species was also observed with *Ophionereis* sp. more abundant in the shallower coarse sand sediment depths and *Amphiodia urtica* in the deeper, silty-sand sediments.

The most frequently observed fish taxa in soft-sediment habitat areas were cuskeels (*Chilara* sp), eelpouts (*Lycodes* sp.), assorted flatfishes, including sanddabs (*Citharichtys* sp.), Dover sole (*M. pacificus*) and English sole *(P. vetulas),* tonguefish (*S. atricauda),* as well as pink surfperch (*Z. rosaceus*), hagfish (*E. stouti*), anchovies (*E. Mordax*), and the olive rockfish (*Sebastes serrinoides*) and numerous unidentifiable juvenile and adult rockfishes (*Sebastes* spp.), poachers (Algonidae), and sculpins (Cotidae).

Organisms observed in hard-bottom habitats along the nearshore cable routing consisted mostly of sessile taxa that are restricted to solid substrata. Analysis of photographs using point-contact methods suggested the greatest percent of hard substrata was covered by the anemones *Metridium farcimen (=giganteum)*, *Corynactis californica* and *Urticina lofotensis*, followed by bryozoans (e.g., *Cellaria* sp., orange encrusting, orange branching and pink encrusting forms), followed by sponges, such as *Tethya aurantia*, and unknown tan globular and yellow lumpy forms, followed by the seastars *Asterina miniata*, *Dermasterias imbricata*, *Mediaster aequalis*, *Orthasterias koehleri* and *Pisaster giganteus*, followed by the cup corals *Balanophyllia elegans* and *Paracyathus stearnsi*. Also observed in video records from hard-bottom habitat were encrusting coralline algae, the red alga *Rhodymenia* sp., a saucer-shaped sponge, a white foliose sponge, a white encrusting sponge, a white erect sponge, a yellow puff ball sponge, a yellow encrusting sponge, an orange encrusting sponge, an orange puff ball sponge, an orange foliose sponge, a red encrusting sponge, the anemones *Urticina columbiana*, *U. piscivora*, *Stomphia coccinea*, and unidentified cerianthids, the hydrocoral *Stylaster californicus (=Allopora californica)*, the gorgonians *Lophogorgia chiliensis* and *Adelogorgia phyllostera*, the crab *Cancer* sp., the sea stars *Mediaster aequalis*, *Orthasterias koehleri*, *Ceramaster patagonicus*, *Henricia* sp., and *Pisaster brevispinus*, crinoids (probably *Florometra serratissima*), the ascidian *Ascidia paratropa*, the cabezon, *Scorpaenichthys marmoratus*, the olive rockfish, *Sebastes serranoides*, the rosy rockfish, *Sebastes rosaceus*, the brown rockfish, *Sebastes auriculatus* and juvenile rockfishes.

Quantitative data from analysis of photos revealed several differences in organism abundances associated with the relief of hard-bottom habitat and different survey segments, which correlated roughly with water depth. The Shannon-Weaver diversity index and the coverage of the compound ascidian *Cystodytes* sp. were greatest in photos from high-relief habitat. Encrusting coralline algae were found only in the shallower, more inshore regions of the survey area and coverage of the anemone *M. giganteum* and overall living cover were significantly greater in the deeper, more offshore regions of the survey area than in the shallower, more inshore areas.
No invertebrate or fish species of special significance or concern were observed. The California hydrocoral *Stylaster californicus (=Allopora californica)*, a federally protected species in Southern California, was observed but occurred infrequently in the high-relief areas in Survey Segments C and D, at water depths less then 80.5m (264ft). Several marine mammals were also observed on the sea surface or diving in the water column during ROV operations included a California sea lion (*Zalophus californianus*), harbor seal (*Phoca vitulina*), and California sea otter (*Enhydra lutris*).

Comparing survey observations and data from the current survey with those previously collected in the area (SAIC, 1999) indicate that no substantial changes in either marine habitat or associated biota appear to have occurred over the past eight years within the nearshore Morro Bay region.

2.0 Project Overview

AT&T is proposing to install a new trans-Pacific fiber-optic cable between the United States and Southeast Asia, with the US landfall at Montana De Oro State Park, in Los Osos, California. The new cable, called the Asia America Gateway (AAG) project, will be the first direct terabit (one billion bits) submarine cable network to link Malaysia to the US via Singapore, Thailand, Brunei, Vietnam, Hong Kong the Philippines, Guam, Hawaii and the West coast of the U.S.

In 2000 and 2001, MCI directionally drilled a series of bore holes from the Montana de Oro State Park sand spit parking lot that transited under the adjacent beach and intertidal and near-shore sub-tidal regions of the coast. Two of these borepipes were subsequently assigned by MCI to AT&T, with approval from the California State Lands Commission. These bore pipes exited the seafloor in approximately 70–feet of water. All of the horizontally directionally drilled (HDD) boreholes, except one, drilled in 2000 were used for the fiber-optic cables installed in 2001. Within the coastal region of the cable installation, the installed fiber-optic cables were laid along the seafloor within a pre-determined cable route/path that avoided sensitive hard and soft-bottom habitat to the maximum extent feasible.

The proposed Asia America Gateway fiber-optic cable will utilize the previously bored, but unused bore pipe, at Montana De Oro State Park, to transit the intertidal and near shore habitats. In addition, it will follow a similar subsea route through the coastal area offshore of Morro Bay, as used by previous cables, in order to maximize avoidance of sensitive hard and soft-bottom habitat areas. Figure 1 illustrates the general location and orientation of the proposed cable route and the portion covered by the biological survey.

As part of its CEQA environmental review process, the California State Lands Commission requested that a new marine habitat and biota survey of the seafloor along the nearshore portions of the proposed cable route be conducted. The primary objective of the survey was to obtain sufficient visual data (color video and still images) to describe the existing epibenthic community structure inhabiting both soft and hard-bottom habitat located within the 100-m wide cable right-of-way of the proposed cable route. This Survey Report presents the results and conclusions resulting from a remotely operated vehicle (ROV) based photographic survey of approximately 7.6 nautical miles of the nearshore portion of the cable route.

3.0 Survey Methodologies

AMS conducted a biological survey of the nearshore portion of the fiber optic cable right-of-way located offshore Morro Bay, California on October 11-13, 2007 using a remotely operated vehicle (ROV). Messrs. Jay A. Johnson and Dane D. Hardin with AMS were the onboard observers during the survey. To facilitate field operations, subsequent laboratory analysis, and data presentation, the cable route was divided into six Survey Segments (labeled A through F), which roughly corresponded to anticipated differences in habitat types and water depths that might result in different biological communities or differences in dominant taxa as a result of habitat conditions. Figure 2 illustrates the location of these six Survey Segments. The following sections detail the equipment and methodologies employed during the survey.

3.1 Field Survey Protocols

3.1.1 Surface Support Vessel & ROV

The surveyed nearshore segment of the fiber-optic cable route for the AAG-S5 cable is presented in Figure 1. The ROV survey was conducted from the 175-ft support vessel M/V Pacific Star. A Hydrosub-10 ROV, owned and operated by DIVECON, Inc. (Oxnard, CA) was used to conduct the survey and was equipped with:

- Color digital video camera,
- Digital still camera (7.3 megapixels) and strobe,
- Mesotech-1000 Color scanning sonar to assist in locating hard-substrate features,
- BW video for low light conditions, and
- Lasers for providing photographic scales and ensuring consistent sized photoquadrats.

Both the color video camera and digital still camera used for photo-documenting seafloor habitat and associated biota were mounted on a pan/tilt unit located on the front bumper of the ROV to allow the tilting of the still camera into a near vertical position for the collection of photoquadrats. To aid in quantifying the area within a photograph, as well as for providing a means of measurement on photos and video, to two lasers were mounted under the cameras on the pan/tilt unit. Initially, the pan/tilt unit was mounted such that the point of convergence of the two lasers placed the ROV a set distance from the substrate and allowed the photographing of a 0.25-meter squared viewing area (photoquadrat). This offset distance and corresponding photoquadrat area was used in previous ROV surveys of the area (SAIC, 1999) and was determined by SAIC personnel to achieve optimum clarity in the photographs, since greater offsets resulted in reduced data quality due to near bottom turbidity.

The digital video feed from the ROV was recorded onto DVD's using a JVC DVD recorder. Superimposed on each video were the ROV heading, water depth, survey date, and time stamp in hours, minutes, and seconds. Digital images were recorded onto a one-gigabyte flash memory card inside the camera with a 700+ image capacity at maximum resolution (7.1 megapixels). Each image included a date and time stamp.

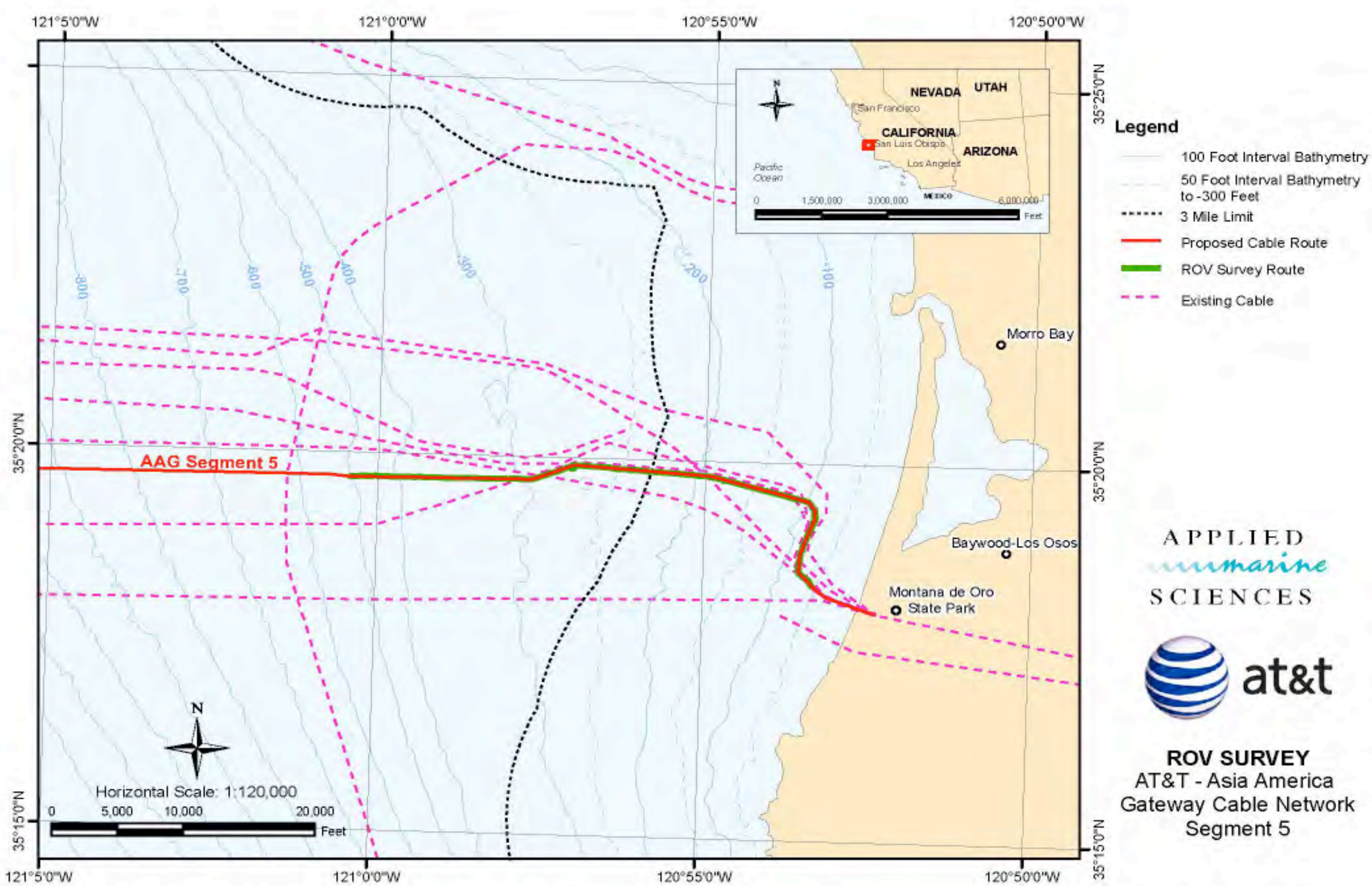

Figure 1: Location of ROV Biological Survey and Nearshore Route of the AT&T AAG S-5 Fiber Optic Cable.

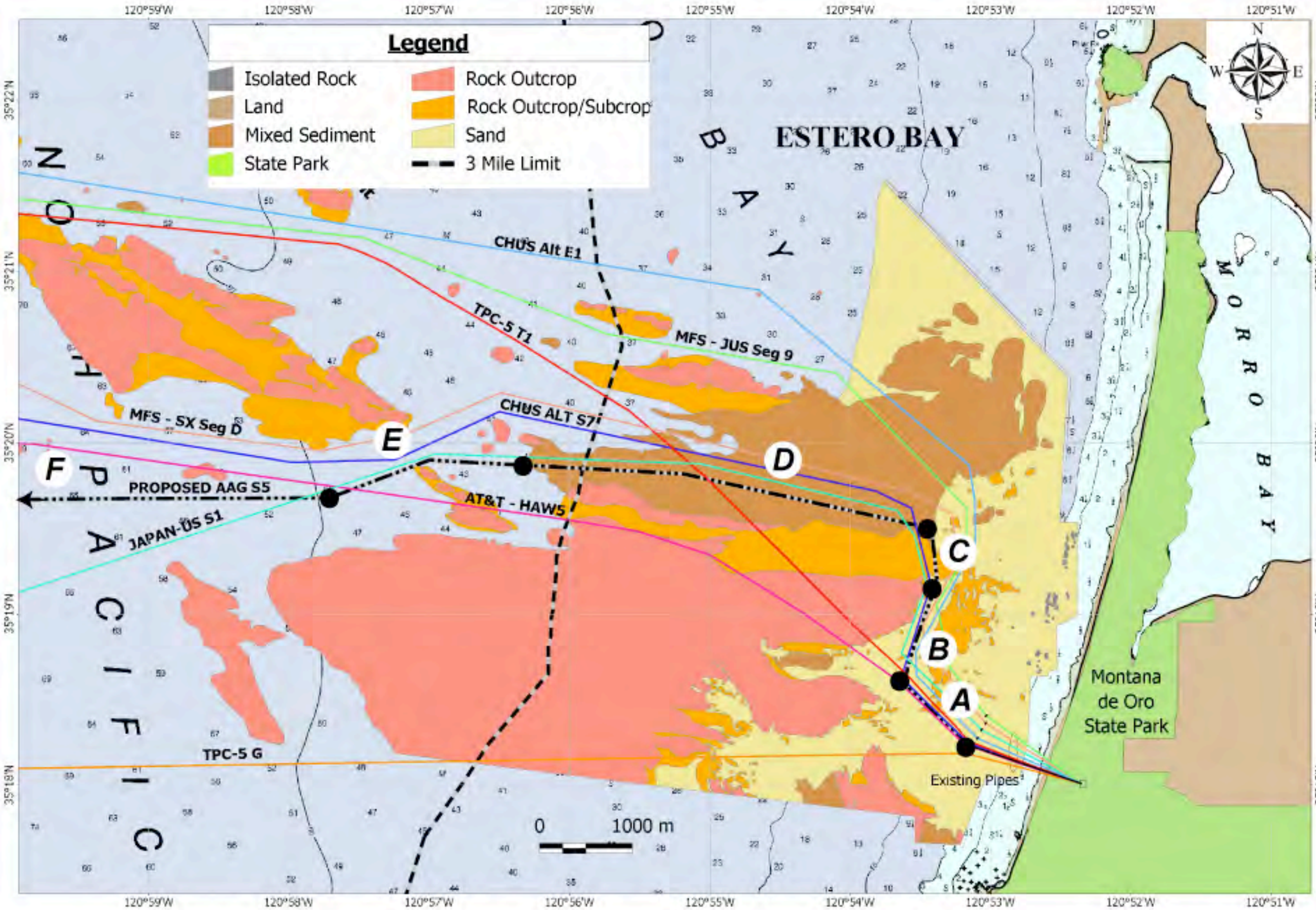

Figure 2: Biological Survey Segment Locations for the AAG S-5 Fiber Optic Cable Route.

Scientific field crews maintained a dive observations and information log that tracked time, navigation fixes, water depth, when photos were taken, habitat type, and any noteworthy observations. Dive transects were conducted at ROV speeds ranging between 0.3-0.5 knots. In hard-bottom areas and when taking still photos, the ROV was operated at much slower speeds.

3.1.2 Surface Vessel and ROV Navigation

Navigation and positioning of the surface support ship and ROV along the proposed fiber optic cable route was performed by personnel from Fugro West, employing Differential Global Positioning Satellite (DGPS) navigation. The configuration of Fugro's Positioning System for acoustic tracking of an ROV along a pre-determined cable route is based on a powerful menu-driven navigation software system that allowed the integration of input data collected from a number of navigation sensors combined with pre-plotted data that allows for "real time tracking" of the support vessel and ROV as detailed below.

Vessel Positioning: Positioning of the vessel was accomplished through the utilization of a DGPS positioning system and integrated navigation software. Real-time corrections are transmitted via a dedicated communications satellite transponder to the vessel.

The corrections themselves are pseudo-range corrections and range-rate corrections for every satellite in view. The GPS base stations that collectively comprise the Fugro Wide Area Differential (WAD) network are located throughout the world. These base stations make real-time differential observations of the GPS satellite constellation in their view. The differential data were further enhanced by applying corrections for ionospheric and tropospheric distortions. The enhanced data were then uplinked to a dedicated communication satellite transponder where they were simultaneously transmitted to the vessel. This method of transmitting Wide Area Differential requires no local base station, has no radio range or line-of-sight considerations, and produces a position accuracy on the order $\pm$1 meter RMS, or better.

Additional input data including vessels heading information from the gyrocompass were logged at every fix mark. Computer logged position information was stored on disk and backed up by hard copy print out. Position fix marks were generated from the computer system at 100-meter intervals along the pre-plotted fiber-optic cable route, whenever a photo was taken, and whenever the surveying marine biologist requested a position fix be made, such as at the start of a hard-bottom habitat area along the route.

Vessel Heading: A survey grade digital Gyrocompass was used to provide vessel heading and allow for the accurate position of offsets for the acoustic tracking system hydrophone and bearings to the ROV.

Subsurface Bearing and Distance: Subsurface acoustic positioning of the ROV was accomplished using an Ocean Research Equipment (ORE) Trackpoint II Ultra Short Baseline system. The system determines relative range and bearing from the surface vessel to a mini transponder attached to the ROV and therein providing accurate subsurface positioning data. The system comprises a control and display unit (CDU), a hydrophone and an acoustic beacon mounted on the ROV.

Range and bearing information is output to the surface positioning system for further transformation to a real-time position. The Ultra short baseline system derives it name from three sensors located on the hydrophone w transmitting and receiving acoustic signals. The three sensors form an ultra short baseline between themselves that receive acoustic signals. The returning acoustic signal from the transponder arrives at each sensor at a different time. This time phase difference comparison is processed by the central processing unit to derive a direction and distance to the transmitting beacon on the ROV

System Software: The FUGRO positioning system utilizes a PC based navigation system that has the capability of interfacing DGPS positions of latitude and longitude and converting them to the appropriate coordinates as necessary. In addition to data acquisition of positioning data the software interfaces with external instruments such as echo sounders, Ultra Short Base Line acoustic systems, side scan sonar and geophysical equipment for annotation of records. One of the systems strengths is its ability to import Cad generated maps and digital charts and have them depicted on several graphics display monitors that can be stationed throughout the vessel.

The graphic monitor displays a scaled depiction of the vessel orientation to the survey lines and or subsurface targets, range and bearing from the vessel or ROV to the target. The surveyor can control the scaling of the graphics to assist the vessel helmsman in fine-tuning the vessel's position. The software is configured to allow the operator to select operating coordinate system and zone, pre-plotted data file, output logging file, logging file interval, and vessel offsets from the GPS antenna to the Trackpoint hydrophone pole. Once these selections are input, the software interrogates data output from the differentially corrected GPS satellite positioning system, the vessel heading from a precision gyroscope, and the ROV bearing and distance (relative to the vessel) from the ORE Trackpoint II, to provide the visual and logging output displays.

3.2 Data Analysis

3.2.1 Video and Photographic Analysis

Laboratory evaluation of the video and photographic images were conducted in separate phases. Photographs were initially reviewed to compile a master species list of observed biota and to establish a photographic reference list for subsequent detailed digital still photograph and video analysis. Still photographs and video images were quantitatively analyzed using different protocols based on habitat type. All photographic and video images were analyzed using personal computers equipped with DVD video and still image viewing software.

Soft and mixed-bottom habitat: Prior to the field survey, the proposed cable route was divided into six Survey Segments, designated A through F. These route segments were selected based on habitat type (soft, mixed and, hard-bottom) and water depth. Figure 2 illustrates the location of these six Survey Segments along the proposed cable route. The laboratory analysis of soft-bottom habitat segments consisted of the first five 100-meter segments in each route segment (A-F) being quantitatively analyzed for the identification and enumeration of all observable biota to the lowest taxon practicable. If more than one 2.5-hour DVD disk of video was required to cover the segment, then the first five 100-meter segments of each disk were quantitatively analyzed. Remaining video coverage for that cable Survey Segment (A-F) on each DVD disk was then analyzed for the presence of organisms not previously observed and which could be characterized as present but not abundant. If within a cable segment the habitat changed, each different habitat type was analyzed separately with up to five 100-meter segments being semi-quantitatively analyzed and remaining video footage scanned for occasionally occurring organisms.

Digital still photographs of soft and mixed-bottom habitat areas were individually characterized by water depth and substrate type and all observable biota on each photo identified to the lowest taxon practicable and enumerated. With the exception of the photos taken in water depths greater than 265 feet (Survey Segment F), all soft and mixed-bottom photoquadrats were 0.25 m^2 in size. Digital images for Survey Segment F were taken with the camera positioned in an oblique, forward-looking angle. This resulted in an image significantly larger than 0.25 m^2 in size.

Hard-bottom habitat: Each of the approximately 140 digital photos of hard-bottom habitat were initially reviewed and assessed for suitability for further detailed analysis. Photos had to be clear and have a minimum of 75% of conspicuous individual organisms in the image identifiable in order to be suitable for further analysis. All suitable photos were imported into a Microsoft Windows based computer equipped with a software application called CPCe 3.4. This software, developed by the National Coral Reef Institute (NCRI), allows images to be analyzed using a random point contact (RPC) method of assessing percent cover of an individual organism. The application further allows data to be input into a Microsoft Excel spreadsheet for data storage and subsequent statistical analysis. Although initially developed for assessing organism coverage on coral reefs, AMS adapted the program for use with temperate water hard-bottom habitat and associated communities. A total of 30 random points were displayed over each photo by the program and every organism underlying one of the randomly projected points was identified to the lowest practical taxon and recorded onto excel based data sheets. In addition, all large and conspicuous organisms were identified to the lowest practical taxa and enumerated.

The actual area coverage of each photo was calculated using the pre-set 6-inch distance between the two lasers mounted on the ROV (captured on each photo). Because the distance between the ROV cameras and the hard-bottom fluctuates based on the proximity of the cameras from the substrate this will vary in each photo. Percent cover of all observed taxa was calculated.

3.2.2 Statistical Analysis

Several statistical procedures were used to explore the spatial patterns of hard-bottom organisms throughout the survey area. First, the mean and standard deviation of percent cover were calculated for taxa that were quantified in the point-contact analysis. These statistics were used to rank the abundances of all taxa within each survey segment, in order to better describe how organisms are distributed throughout the survey area. Next, the percent cover data for all taxa were tested for significant differences between locations (i.e., survey segments) and habitat relief by analysis of variance. To improve conformance of the data to the assumptions of parametric statistical tests, all percent cover data were transformed using the arcsine transformation (Sokal and Rohlf, 1995).

4.0 Survey Results & Discussion

The initial proposed route of the AAG S5 fiber optic cable through the nearshore coastal waters offshore Morro Bay, California and that was assessed during the October 2007 ROV Biological Survey encountered marine communities that varied both by habitat type, water depth, and ecological conditions. Both low- and high-relief hard-bottom habitats, as well as fine-mud, fine-sand, and coarse-sand soft-substrate habitats, were encountered in water depths ranging between 21.3-85.3m (70-500ft) water depths. To facilitate field operations and subsequent laboratory analysis, the surveyed portion of the cable route was divided into six Survey Segments, corresponding to anticipated differences in habitat types and water depths, that could be expected to result in different biological communities or differences in dominant taxa, as a result of habitat conditions (Figure 2).

A post plot of observed habitats (Figures 3b-3f, Table 1) revealed that soft-bottom was the predominant type of habitat observed along the initial proposed cable route. Of the 14km (7.6 nautical miles) surveyed, approximately 11.9km (84.8%) were soft-bottom. Hard-bottom covered approximately 0.88km, or 6.3% of the survey area. This hard-bottom consisted mostly of low-relief habitat (4.1%), with the remainder being high-relief habitat (2.1%). Mixed-bottom, consisting of cobbles or scattered rocks with sandy or muddy substrate, covered approximately 9.1% of the seafloor along the ROV surveyed route. A large area of sand waves along Survey Segment D covered approximately 18% of the survey area.

As discussed in Section 2.0, subsequent to the conduct of the ROV Biological Survey in October 2007, new data from a multi-beam side-scan sonar survey of the initial cable route, combined with observations and habitat mapping from the ROV Biological Survey, resulted in changes in the initial proposed cable route to avoid concentrated areas of hard-bottom habitat. The final 14.6 km proposed route for the AAG S-5 fiber optic cable transiting the nearshore segment of the cable route consists of 85.6% (12.5 km) soft-bottom habitat, 9.3% (1.3 km) of mixed sand and coble bottom, and 3.5% (0.51 km) of hard-bottom habitat. The hard-bottom habitat along the route is estimated at 3.4% (0.50 km) of low-relief rock outcropping and 0.01% (0.07 km) of high-relief hard-bottom habitat. The proposed cable alignment significantly reduced the amount of hard-bottom habitat over which the cable will be located, and avoids all but one potentially minor area (<10 m) of high-relief habitat (Table 1, Figure 3c).

The following Sections present detailed information on the seafloor habitat and associated biota observed along each of the six cable Survey Segments. They also present brief discussions of what habitat and biota are expected to be present along the realigned route segments in the final proposed cable route. Figure 2 illustrates the location of each of the surveyed segments along the surveyed cable route and Figures 3b-3f provide detailed seafloor mapping for both the initial and final proposed cable routes. Tables 2 and 3 provide species lists of all plant, invertebrate and fish species observed during the entire survey.

Table 1: Amount of seafloor covered by each habitat type along the initial proposed cable route surveyed by the ROV Biological Survey and along the final proposed cable route.

Habitat Type	Initial Cable Route		Final Proposed Route	
	Kilometers Covered	% Of Survey Area	Kilometers Covered	% Of Survey Area
Soft Substrate (SB)	***11.9***	***85.0***	***12.5***	***85.6***
Fine & Medium Sand (Survey Segments A, B, & C)	**1.93**	**13.8**	**2.06**	**14.1**
Fine Sand & Silt	**7.42**	**53.2**	**7.49**	**51.3**
Coarse Sand Waves/Troughs (Survey Segment D)	**2.52**	**18.0**	**2.95**	**20.2**
Mixed-bottom (MB)	***1.3***	***9.1***	***1.3***	***8.9***
Sand & Cobble	**1.3**	**9.1**	**1.3**	**8.9**
Hard-bottom (HB)	***0.88***	***6.2***	***0.51***	***3.5***
Low-relief	**0.58**	**4.1**	**0.50**	**3.4**
High-relief	**0.30**	**2.1**	**0.01**	**0.07**